

FIRST REARING OF THE DICTYNID SPIDER SPECIES, *Nigma conducens* (O. PICKARD-CAMBRIDGE, 1876) IN EGYPT

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ABSTRACT

Nigma conducens (O. Pickard-Cambridge, 1876) (Family Dictynidae) is reared for the first time in Egypt. The individuals of this species were collected from citrus green houses, Cairo Governorate, Egypt. Biological aspects were studied under laboratory conditions (26-28°C & 60-70% R.H.). Life cycle of males and females averaged (77.92±3.6 & 77.66±0.8 days) after 5 spiderlings, when fed on the adult of the fruit fly *Drosophila melanogaster* and averaged (102.52±3.64 & 103.53±4.42 days), when fed on the adult of the mulberry white fly *Pealius mori*. Food consumption was observed.

Keywords: *Nigma conducens*, life cycle, *Drosophila melanogaster*, *Pealius mori*, biological aspects, food consumption.

INTRODUCTION

Family Dictynidae has a moderate number among 113 families recorded all over the world. From this family, 588 species of 53 genera are distributed all over the world (World Spider Catalog, 2016), while in Egypt, five genera and six species are recorded (El-Hennawy, 2006).

The Dictynids constitute a widespread family of small to medium-sized, cribellate spiders which make irregular webs. Different species of this family live under a variety of types of social organization Jackson (1979). The Dictynidae, includes genera as *Dictyna*, *Emblyna* and *Nigma* which are mostly plant dwellers and found in low vegetation as well as higher up such as shoot apices of grass and bushes or the foliage of trees Van Helsdingen (2009).

Observations of courtship and mating have been reported for about 12 species of Dictynidae (Karpinski, 1882; Montgomery, 1903; Berland, 1916; Gerhardt, 1924; Billaudelle, 1957; Leech, 1966; Bristowe, 1971), then Jackson's (1979) analysis of sexual behavior in two *Mallos* species and *Dictyna calcarata* Banks (1904), observations were mostly rather superficial, with less data. In recent years, much attention has been focused on the permanently social *Mallos gregalis* (Simon, 1909), which has in turn called comparative attention to the behaviour of more typically solitary or intermediate species (Uetz, 1983). After that, Starr (1988) recorded the sexual behaviour and mating of *Dictyna volucris* Keyserling (1882) from Kansas, USA, then Wheeler *et al.* (1990) studied biology of the two species of *Dictyna* (*D. major* and *D. coloradensis*) in laboratory and field in Idaho.

In Egypt, genus *Nigma* has one species *N. conducens* (O. Pickard-Cambridge, 1876) which is recorded from Cairo, Lower Egypt, Elephantine, Philae Island (Aswan), Wadi-Halfa (El-Hennawy, 2006) and in this work, this species was collected for the first time from citrus green houses in Giza; so it is considered as a new locality record from Giza Governorate.

No biological studies on *Nigma conducens* have been done in the world and any species of the family Dictynidae in Egypt. Therefore, it is necessary to study its life cycle, to give some knowledge about its role in the agroecosystem and as the first step to study some sociality in this species.

MATERIAL AND METHODS

Source of dictynid spiders (Mesh Web Weaver) *Nigma conducens* (O. Pickard-Cambridge, 1876):

Pure cultures of adult females of the family Dictynidae were collected from citrus green houses, Giza Governorate, then transferred to the laboratory. As the first step to identify the species; the genus and species was identified according to Lehtinen (1967). Adult females were reared inside plastic vials, fed until they laid egg sacs and observed till eggs hatched. 75 individuals of spiderlings hatched from 7 egg sacs, divided into two groups (34 and 41 spiderlings) and fed on two preys; adults of fruit fly *Drosophila melanogaster* (Order: Diptera) and Mulberry Whitefly *Pealius mori* (Order: Hemiptera).

The hatched spiderlings were reared individually in translucent plastic vials (3 cm in diameter and 5 cm in length); the upper lids of the vials were perforated for ventilation. All obtained spiderlings were reared under laboratory conditions of 26-28°C and 60-70% R.H. The two groups were fed twice every week on adult fruit flies and white flies. Spiderlings were supplied with a known number of prey and observed until they reached maturity. These adult male and female individuals were examined three times every week and the consumed individual preys were replaced by fresh ones. Adult females were allowed to mate and left solitary for oviposition. The biological aspects and behaviour of different spiderlings of this species was conducted. The life cycle and food consumption were determined.

Source of food: Two types of food were used in this study.

1. The fruit fly *Drosophila melanogaster* (Order: Diptera)

For mass rearing of *Drosophila melanogaster*, 40 mature males and females were kept in 8 plastic jars containing fresh fruit diets, each vial contained 5 individuals of *Drosophila melanogaster* and kept in incubator set at 25°C. After 7 to 10 days, adult fruit flies were collected from a small tip of the inverted jar to feed the spider individuals.

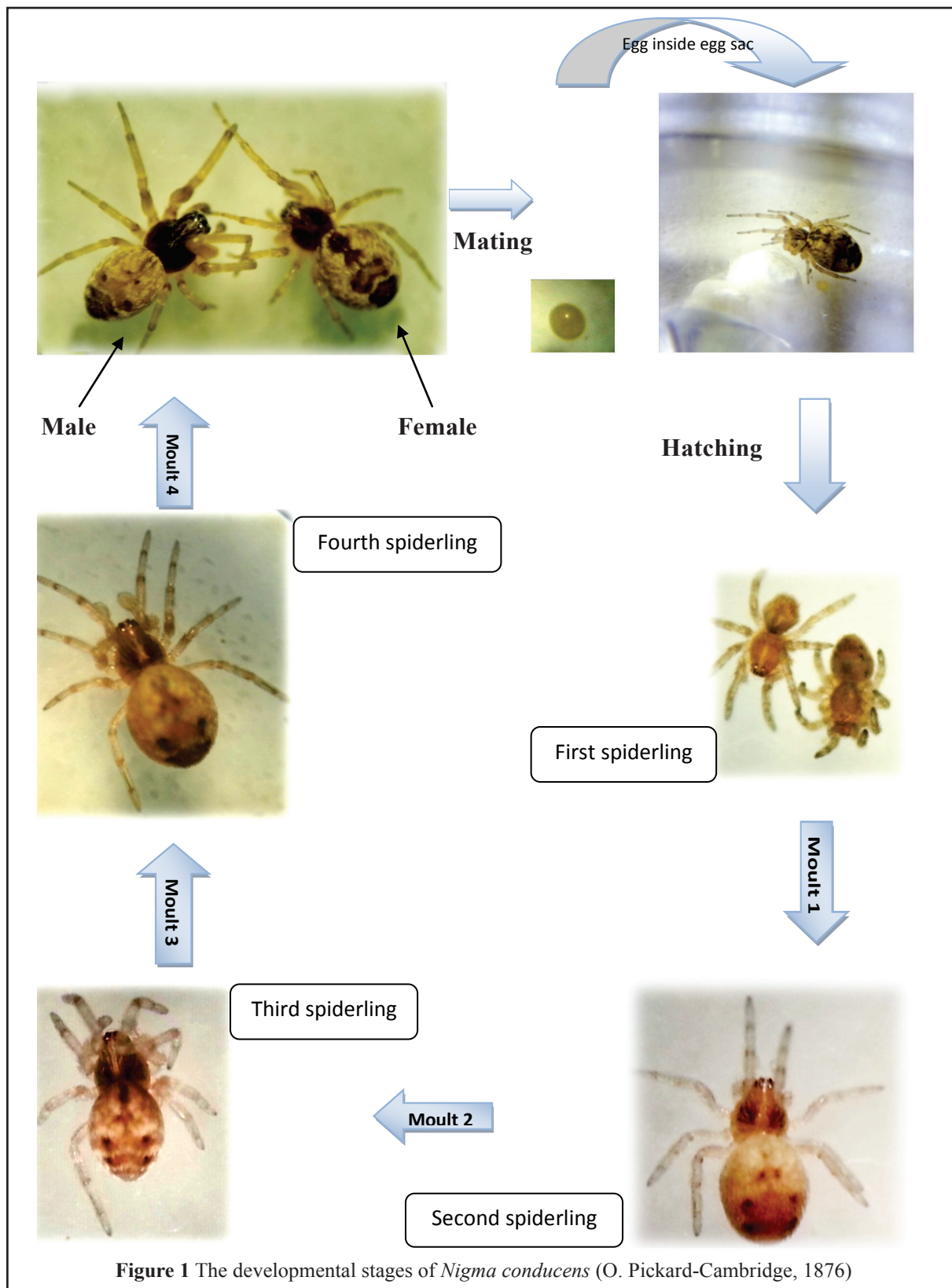
2. Mulberry Whitefly *Pealius mori* (Order: Hemiptera)

Adult mulberry white flies were collected three times every week from highly infested mulberry trees to feed the spider individuals. Flies were collected by plastic jars and covered with white clothes, then the flies were collected through a small hole at the top of the jar to feed the spider individuals. This method was repeated three times a week.

RESULTS AND DISCUSSION

Egg sacs and eggs incubation period

The laid egg sac was spheroid, small in size and white at first, then became dark before hatching (Figure 1). The eggs inside the egg sac were circular and yellow at the beginning after laying then became dark before hatching, number of eggs ranged from 7-14 eggs per egg sac with an average of 10.7 ± 2.4 eggs. These results differed with Wheeler *et al.* (1990) who reared another species of family Dictynidae, *Dictyna coloradensis*, egg mass of which contained an average of 14.6 ± 0.7 eggs. 75 individuals from 7 egg sacs, hatched and emerged through a round



pore at the tip of the egg sac. They were divided and reared under laboratory conditions. All the individuals of spiderlings were moulted before leaving the egg sacs (1st moult).

The incubation period of eggs of *Nigma conducens* lasted for 19-24 days and averaged 21 days (Table 1) when fed on the adult fruit flies *Drosophila melanogaster*, while lasted for 18-20 days and averaged for 19.33 days when fed on adult mulberry white flies *Pealius mori* (Table 2). These results indicate that the type of prey may affect the duration of the incubation period; it was longer when females fed on *D. melanogaster* than on *Pealius mori*.

Table 1 Life cycle of spider species, *Nigma conducens* when fed on adult fruit flies, *Drosophila melanogaster*.

Stage	Duration (Days)			
	Range		Sex (Mean \pm S.D.)	
	Male	Female	Male	Female
Incubation period of egg sac	19-24	19-24	21.0 \pm 0.0	21.0 \pm 0.0
First spiderling	13-18	13-15	15.0 \pm 1.7	14.3 \pm 0.8
Second spiderling	14-20	17-18	17.1 \pm 2.1	17.8 \pm 0.4
Third spiderling	11-14	11-14	12.6 \pm 1.1	12.0 \pm 1.2
Fourth spiderling	10-14	12-14	12.0 \pm 1.6	12.5 \pm 0.8
Life cycle	70-83	77-79	77.9 \pm 3.6	77.6 \pm 0.8

Spiderlings. During rearing of the two groups (75 individuals) of spiderlings of *N. conducens*, the spiderlings passed through 5 instars for both males and females with four moults, when fed on adults of both, fruit flies and mulberry white flies (Figure 1 and Table 1). These results disagree with Wheeler *et al.* (1990) who reared *Dictyna coloradensis*; their results indicated that species matured after variable number of instars (6-10). But in this study, the first instar average is 15.0 \pm 1.7 and 14.3 \pm 0.8 days for male and female respectively, when fed on adult fruit flies, *D. melanogaster*. These results seem to be near to those of Wheeler *et al.* (1990), the first instar lasted for 13.1 \pm 0.6 days when fed on the same prey, adult fruit flies *D. melanogaster*.

Table 2 Life cycle of the spider species, *Nigma conducens* when fed on adult mulberry white flies, *Pealius mori*.

Stage	Duration (Days)			
	Range		Sex (Mean \pm S.D.)	
	Male	Female	Male	Female
Incubation period of egg sac	18-20	18-20	19.3 \pm 0.0	19.3 \pm 0.0
First spiderling	10-12	10-12	10.6 \pm 1.0	10.4 \pm 0.8
Second spiderling	30-35	30-35	32.1 \pm 1.6	32.4 \pm 1.7
Third spiderling	18-24	18-26	21.4 \pm 2.5	21.6 \pm 3.0
Fourth spiderling	18-21	14-23	19.3 \pm 1.2	19.9 \pm 3.2
Life cycle	97-107	93-111	102.5 \pm 3.6	103.5 \pm 4.4

Life cycle. Life cycle lasted for 77.92 ± 3.6 and 77.66 ± 0.8 days for males and females respectively when fed on adult fruit flies *D. melanogaster* (Table 1), while lasted for 102.52 ± 3.64 and 103.53 ± 4.42 when fed on adult mulberry white flies, *P. mori* (Table 2). Life cycle of the individuals of this species seemed to be shorter when fed on adult fruit flies than when fed on adult mulberry white flies.

Sex ratio. 19 spiderlings (13 males and 6 females) reached adult stage when fed on adult *D. melanogaster*; while 22 spiderlings reached to adult stage (9 males and 13 females) when fed on adult *Pealius mori*. These results denote that the type of food may change the sex ratio between the two groups of spiders.

The sex ratio of adults was 2.16:1 (males: females) when the spider individuals fed on adult *D. melanogaster*; while it was 1:1.44 (males: females) when the spider individuals fed on adult *P. mori*.

Food consumption. During the study of food consumption of the spider *Nigma conducens*, different spiderling instars and adults in two groups were fed on two kinds of prey, the adult fruit flies *Drosophila melanogaster* and the adult mulberry white flies *Pealius mori* (Table 3). The total number of consumed prey individuals averaged 85.76 ± 3.81 and 96.67 ± 1.96 for male and female respectively when fed on the adult *D. melanogaster*; while the total number of consumed individuals averaged 916.2 ± 3.38 and 938.7 ± 3.83 when fed on adult *Pealius mori* (Table 4). These results indicate that the spider species, *Nigma conducens* consumed a large number of adult mulberry white flies than the number of adult fruit flies; these results may be due to the size of the prey.

Table 3 Food consumption of the spider species, *Nigma conducens* when fed on adult fruit flies, *Drosophila melanogaster*.

Stage	Number of consumed individuals of prey			
	Range		Sex (Mean \pm S.D.)	
	Male	Female	Male	Female
First spiderling	11 - 15	12 - 15	12.8 ± 1.4	13.8 ± 1.1
Second spiderling	17 - 25	23 - 27	20.7 ± 2.2	25.3 ± 1.3
Third spiderling	22 - 29	25 - 28	25.6 ± 2.0	26.1 ± 1.1
Fourth spiderling	24 - 30	29 - 34	26.5 ± 1.6	31.3 ± 1.8
Total	80 - 92	95 - 100	85.7 ± 3.8	96.6 ± 1.9

Table 4 Food consumption of the spider species, *Nigma conducens* when fed on adult mulberry white flies, *Pealius mori*.

Stage	Number of consumed individuals of prey			
	Range		Sex (Mean \pm S.D.)	
	Male	Female	Male	Female
First spiderling	41 - 50	48 - 53	46.2 ± 2.8	50.1 ± 1.7
Second spiderling	227 - 234	224 - 235	230.1 ± 2.7	230.0 ± 2.6
Third spiderling	310 - 318	313 - 325	315.4 ± 2.4	319.0 ± 3.2
Fourth spiderling	320 - 328	335 - 346	324.4 ± 2.7	339.6 ± 3.3
Total	910 - 921	931 - 946	916.2 ± 3.3	938.7 ± 3.8

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